



The Oceanography Report
The focal point for physical, chemical, geological, and biological oceanography.

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U.S. To Aid Coastal Research

Mary Hope Katsouras

Prior to the 1984 implementation of the 1958 Convention on the Continental Shelf, oceanographers were free to plan and carry out research projects virtually anywhere on or under the seas of the world (see Article 5(1) and 5(8)). Today, dozens of coastal nations regulate marine research within 200 nautical miles (370 km) of their shores, imposing increasingly severe restrictions and creating diverse and uncertain transit procedures. Both the Reagan administration and Congress have acted recently to alleviate some of these jurisdictional problems being experienced by U.S. marine scientists.

On March 11, 1983, President Reagan issued a proclamation on the "Exclusive Economic Zone of the United States of America" and related statements. It is the accompanying "Statement by the President" and the "Fact Sheet" on "United States Oceans Policy" (all three of which are dated March 10), rather than the proclamation, that outline the U.S. position on the conduct of marine scientific research. The "Statement by the President" declares that:

While international law provides for a right of jurisdiction over marine scientific research within such a zone, the proclamation does not assert this right. I have elected not to do so because of the United States' interest in encouraging marine scientific research and avoiding any unnecessary burdens. The United States will nevertheless recognize the right of other coastal states to exercise jurisdiction over marine scientific research within 200 nautical miles of their coast, if that jurisdiction is exercised reasonably in a manner consistent with international law.

The "Fact Sheet" states that:

The President has decided not to assert jurisdiction over marine scientific research in the United States EEZ (Exclusive Economic Zone). This is consistent with U.S. interest in promoting maximum freedom for such research. The Department of State will take steps to facilitate access by U.S. scientists to foreign EEZ's under reasonable conditions.

On March 11, 1983, Rep. John B. Breaux (D-La.) and Sen. Ted Stevens (R-Alaska) introduced companion bills in Congress (H.R. 2061 and S. 750) to implement the proclamation and statement. Section 105 of the legislation (1) defines a "marine scientific research area," (2) directs the Secretary of State to submit promptly to the appropriate officials of a coastal nation requests by U.S. scientists for permission to conduct marine scientific research in the marine scientific research area of that nation, and (3) instructs the Secretary of State to initiate negotiations for the purpose of obtaining bilateral and multilateral agreements.

Section 105 defines a marine scientific research area as (1) an area the inner boundary of which is the base line from which the territorial sea of the coastal state is measured and the outer boundary of which is a line drawn in such a manner that each point on it is two hundred nautical miles from the inner boundary; and (2) the continental shelf of the coastal state.

In directing the Secretary of State to submit research requests to other countries on behalf of U.S. scientists, Section 105 also directs the Secretary to declare, as part of the request, that the United States recognizes marine scientific research as a freedom of the high seas. However, neither the Policy Statement, the Proclamation, nor the Fact Sheet

indicate that such research is a freedom of the high seas.

The international agreements specified in Section 105 are intended to reduce the financial and procedural burden of obtaining research permission. Furthermore, the legislation states that agreements should be sought with those coastal nations in which U.S. marine scientists have expressed the greatest research interest.

Congressional interest in the issue was previously indicated on January 6, 1983, when Rep. Gerry E. Studds (D-Mass.) introduced H.R. 703 to facilitate the conduct of international marine scientific research. This bill differs from the Presidential proclamation and the implementing legislation because it asserts the right of all coastal countries to regulate, authorize, and conduct marine scientific research on the Outer Continental Shelf and in coastal waters out to 200 nautical miles. It provides, further, that marine research may be conducted by scientists in any area under U.S. jurisdiction, provided that the research is conducted in a lawful manner. Like the later legislation, H.R. 703 also requires the Secretary of State to transmit marine research requests from U.S. scientists to other countries and to initiate negotiations that will facilitate international marine scientific research.

What do these developments mean to marine scientists?

Until the issuance of the proclamation, the United States had been unable to process requests by U.S. scientists to conduct research in waters adjacent to other nations unless a portion of the research was to be conducted within 3 nautical miles (5.5 km) of shore, up to 12 nautical miles (22.2 km) for fisheries research, and, with respect to the shelf research, throughout the coastal state's Outer Continental Shelf. This policy caused hardships for many U.S. marine scientists in recent years because they were forced to alter significantly the scope and cost of their research projects in order to gain Department of State cooperation in forwarding research requests. The new role specified for the Department of State in the proclamation will alleviate this problem (memorandum of March 11, 1983, by William Erb, Director, Office of Marine Science and Technology Affairs, Bureau of Oceans and International Environmental and Scientific Affairs, Department of State).

Thus, the science provisions of the proclamation appear to be forthright. They foster marine scientific research by all in the U.S. EEZ, while recognizing the right of other coastal nations to claim jurisdiction over marine scientific research.

It is too soon to predict the reaction of other coastal nations to the Reagan proclamation. Some observers feel that there may be a flurry of unilateral claims by other coastal nations directed solely against the United States—a reaction similar to that which greeted the Truman Proclamation. This opinion is based on the selective nature of the proclamation (for instance, its refusal to recognize coastal nations' jurisdiction over tuna).

There are other issues that the marine scientific community needs to consider especially now when the Congress and the Administration have demonstrated their interest and concern regarding the problems facing U.S. marine scientists who want to do research abroad.

The first set of questions to be addressed deal with the President's statement that the U.S. will recognize other coastal jurisdictions only if they are "exercised reasonably in a manner consistent with international law." How will the standards both of "reasonableness" and "consistency with international law" be established? Should requests be forwarded even if the United States does not agree that all the restrictions imposed by a foreign country are consistent with international law? For example, Trinidad and Tobago specify two additional prerequisites for approval of a research project. The first is that research data and results may be published only with the governments' consent and, second, that all data and specimens are the property of Trinidad and Tobago.

If the U.S. considers a nation's policy unreasonable, should a dialogue be initiated in the hope that a foreign state will alter its policies? In this regard, should the Law of the Sea obligations (Article 248 and 249) dealing with marine scientific research be recognized as the upper limits that U.S. marine scientists will accept, and if so, who should monitor whether the obligations have been met? This last point is extremely important because Article 252 of the Law of the Sea provides that a coastal state may withhold consent to research if the researching state or international organization has unfulfilled obligations.

Article 248 of the Law of the Sea requires that the state or international organization in whose or continental shelf of a coastal state provide the coastal state with a full description of the project 6 months in advance. The goal, location, and sponsors of the research project as well as information on the extent

to which the coastal state may participate or be represented in the project.

Article 249 comprises two paragraphs concerning conditions with which the researching state must comply. Paragraph 1 lists the researching state's (or international organization's) obligations, including advance notice to the coastal state participation or representation, providing preliminary reports and final results, provision for access to or receipt of data and samples, helping (on request) the state to assess results, making these results generally available (subject to paragraph 2), informing coastal states of major changes in the project, and removing any installations or equipment after research is completed.

Paragraph 2 declares that the prevailing provisions are without prejudice to other conditions established by the coastal state in the granting or withholding of its consent under prior agreement for making research results available internationally when a project is of direct significance for the exploration and exploitation of natural resources. Although this provision contemplates possible prior restraint on dissemination of research results, it is limited to research related to natural resources, for which consent is a matter of coastal state discretion. Any other conditions, such as requirement of local publications, are also specifically limited to research covered by Article 249(2).

The second set of issues which need to be examined deal with bilateral and multilateral arrangements. The implementing legislation instructs the Secretary of State to initiate negotiations that agreements should be sought with those coastal states in which U.S. scientists have expressed the greatest interest in conducting marine scientific research.

A recent study of U.S. research-vessel clearance experience in the period 1972-1978 shows that 25% of U.S. research was conducted by two countries—Mexico and Canada (Wootter, 1981). If bilateral agreements are to be pursued, should they be with our neighbors? What are the incentives for a coastal nation to enter negotiations to facilitate marine scientific research? Who will pay the costs associated with bilateral and multilateral agreements? Will scientists be asked to participate in the negotiations?

The questions raised thus far only indicate the need for marine scientists to continue to emphasize the uncertainties they face. The proclamation eliminated the problem which the Department of State had in forwarding research requests to other countries. This is a significant step forward; however, it does not resolve all the political constraints facing oceanographers. To ensure the momentum of the proclamation and the implementing legislation, the community must provide its views to the Administration and Congress on procedural issues and on ways in which marine scientific research and international collaboration can be advanced.

Reference

Wootter, W. S., Research in troubled waters: U.S. research vessel clearance experience 1972-1978. *Ocean, Dev. Int. Law* 11, 9, 219-239, 1981.

Mary Hope Katsouras is with the Board on Ocean Science and Policy of the National Research Council. This report reflects the personal views of the author and not necessarily those of the National Research Council.

Information Report

NRC Committees on Oceanography

The dust now is settling from last year's restructuring of the National Research Council (NRC) from seven assemblies and commissions to three commissions, two offices, and an independent board (see April 27, 1982, p. 250, and March 16, 1982, p. 194). The individual committees and boards within these six new units are moving full-speed ahead. This information report reviews four of the new boards that touch on oceanography.

Of all the shifts made to create these four boards, the biggest overhaul involved merging the old Ocean Sciences Board with the old Ocean Policy Committee to form a new Board on Ocean Science and Policy (BOSP) (see May 3, 1982, p. 172). BOSP, which is within NRC's Commission on Physical Sciences, Mathematics, and Resources, first met on May 4, with former NSF director John B. Slaughter, now chancellor of the University of Maryland, as the helm. One of the main problems facing the board, according to Mary Hope Katsouras, BOSP executive secretary, is the vast array of new scientific technologies available and the current lack of a consensus on which ones will be most useful to oceanographers. In addition, oceanographers will need to address the implications of the U.S. not being party to Law of the Sea for marine scientists. A pending bud-

get, fragmentation of activities among government agencies, and the need for one spokesman for the oceanographic community also face these scientists.

The marriage of the old Climate Board and the Committee on Atmospheric Sciences produced the Board on Atmospheric Sciences and Climate (BASC), within the same commission as BOSP. The link between oceanographers and atmospheric scientists and climatologists has become increasingly strong during the last decade, so much so that oceanographers constitute a sizeable contingent on BASC and its various committees. To address the most important scientific issues in atmospheric science and climate, scientists moved to look broadly at global problems. These problems, according to Fred D. White, BASC staff officer, include the Southern Hemisphere's possible connection to climate; solar-terrestrial relations and their effect on the atmosphere; atmospheric chemistry, including acid rain and global tropospheric chemistry; and mesoscale phenomena.

The Polar Research Board (PRB), within the same commission as BOSP and BASC, touches directly on oceanography. The main problems facing polar scientists that the board will address, according to W. Timothy Hoshorn, PRB executive secretary, include the lack of strengthened vessels; the great distance between home ports and the southern oceans; and the high price of ice breakers needed to get to these icy sites.

Within NRC's Commission on Engineering and Technical Systems, the Marine Board (MB) is the result of a merger last year of the Maritime Transportation Research Board and the old Marine Board. Although not working on ocean sciences per se, the Marine Board's work relates to the engineering and technological aspects of ocean science. The board also reviews issues concerning ocean shipbuilding, and safety, according to Arnold M. Gallagher, MB staff officer.

Other NRC boards and committees also touch on oceanography or oceanography-related topics. One such group is the Geophysics Study Committee, which has released a report in December on paleogeography and paleoclimatology, and just released a report on oceanic research and the need for an interdisciplinary approach. From time to time, EOS will review the activities of these other boards.

The NRC was established by the National Academy of Sciences (NAS) in 1961 to assist the science and technology communities with the academy's purposes of furthering knowledge and advising the federal government. The NRC is the principal operating agency of NAS and the National Academy of Engineering; it is administered by both academies and the Institute of Medicine.

For each of the four boards discussed in detail in this report, the NRC staff committee, the board chairman, the highlights of projects completed within the last two years, current projects, and contemplated projects are listed below. A summary of board objectives and goals, which is also provided for each group. Additional information may be obtained from the boards at the following addresses: 2101 Constitution Avenue, N.W., Washington, DC 20418.

Board on Ocean Science and Policy (BOSP)

NRC Staff Contacts: Mary Hope Katsouras and Nancy Maynard (effective July 1), Executive Secretaries (telephone: 202-334-2714).
Board Chairman: John B. Slaughter, Chancellor, University of Maryland, Main Administration Building, Room 1101, College Park, MD 20742.

Objectives and Goals: "To contribute to the advancement of the scientific understanding of the ocean by the maintenance of a continuing oversight of the health of the ocean sciences and the stimulation of their progress. To foster the application of scientific knowledge to the wise use of the ocean and its resources. To assist in the formulation of national and international marine policy and to clarify scientific issues that affect ocean policy. To consider questions of international ocean science and, in particular, the implications of the Law of the Sea Treaty on marine science and scientists. To facilitate communication among ocean scientists and between ocean scientists and scientists in related fields. To address marine science issues involved in efforts to coordinate international oceanographic research, improve technical assistance and cooperation, and assist in the development of coherent fisheries policies."

Completed Reports:
Department of Energy, Oceanographic Program Review.

Current Projects:
Stable Reference Areas for Evaluation of Deep Seabed Mining.
Petroleum in the Marine Environment.
Ocean Research for Understanding Climate Variations—Priorities and Goals for the 1980's.

Two Special Issues in Scientific Oceanography:
Ocean Dynamics and Biological Oceanography.

U.S. Directory of Marine Sciences 1982:
An Assessment of Computational Resources Required for Ocean Circulation Modeling.

Academic Research Vessels 1983-1984:
United States Interests and Needs in the Continuation of International Oceanographic Research.

Interim Report on Stable Reference Areas:
An Evaluation of Fishery and Aquaculture Programs of the Agency for International Development.

Marine Technical Assistance to Developing Countries:
The U.S. Role.

Current Projects:
Future of Marine Geology and Geophysics.

Long-Term, Large-Scale Ocean Science Study on Ocean Thermal Energy Conversion:
Study on Land, Sea, and Air Disposal of Industrial and Domestic Wastes.

Workshop on Global Observations and Understanding of the General Circulation of the Ocean:
Study on Mechanisms to Facilitate U.S. Marine Scientific Research in Waters of Foreign Coastal States.

Effects of Human Activity on the Coastal Ocean:
Projects Contemplated:

Large Fluxes of Organic Matter in Oceanic Ocean Climate Research Panel.
Study on Methods for Defining the Outer Boundaries of the U.S. Continental Shelf and their Policy Implications.

Board on Atmospheric Sciences and Climate (BASC)

NRC Staff Contacts: John S. Patten, Executive Secretary (telephone: 202-334-3374).

Board Chairman: Thomas L. Malone, Holcomb Research Institute, Purdue University, Indianapolis, IN 46206.

Objectives and Goals: "To advance our understanding of the atmosphere and climate, and to improve our ability to apply this

Knowledge for our benefit." Among the board's special functions are providing advice and guidance to appropriate government agencies on objectives, priorities, plans, and implementation strategies for the National Climate Program, on U.S. participation in international research, and for focused national programs in "critical areas of atmospheric science and climate research," fostering the application of scientific knowledge of the atmosphere, climate, and socioeconomic systems to make wise use of the atmosphere and climate resources for the benefit of our country and other nations; studying the impact of weather and climate on human society and how humans affect the atmosphere and climate; and facilitating "communication among the diverse community of scientists concerned with the study of the atmosphere and the climate system, and of their interactions with society."

Completed Reports:
Carbon Dioxide and Climate: A Second Assessment.
Solar Terrestrial Research for the 1980's: Current Mesoscale Meteorological Research in the United States.

Current Projects:
Report of the Carbon Dioxide Assessment Committee.
Global Tropospheric Chemistry: Future Program Needs.

Future Projects:
Global Atmospheric Research Program (GARP) and Associated First GARP Global Experiment (FAGE), Monsoon Experiment (MONEX), and Alpine Experiment (ALPEX).

Low-Level Wind Variability:
Projects Contemplated:

BASC will probably become involved in the Stratospheric Operational and Research Meteorology (SIOROM) program (see March 22, 1982, p. 113).

Polar Research Board (PRB)

NRC Staff Contacts: W. Timothy Hoshorn, Executive Secretary (telephone: 202-334-3370).

Board Chairman: Charles R. Bentley, Geophysical & Polar Research Center, University of Wisconsin—Madison, Weeks Hall, 1215 W. Dayton Street, Madison, WI 53706.

Objectives and Goals: "Advances federal agencies on the status, needs, and opportunities of U.S. polar sciences and research, and as U.S. National Committee for the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions (ICSU), it ensures the participation of the U.S. polar research community in the planning of international research programs under SCAR and in SCAR meetings and related activities."

Completed Reports:
Snow and Ice Research—A Strategy.

Permitting Needs and Priorities for the 1980's:
The Polar Regions and Climate Change Research Emphases in the U.S. Antarctic Program.

Study of the Upper Atmosphere and Near-Earth Space in Polar Regions: Scientific Status and Recommendations on Future Directions.

Polar Biomedical Research—An Assessment:
Current Projects:

Ice Segregation and Frost Heaving.
Antarctic Solid-Earth Geosciences.

Projects Contemplated:
Arctic Geosciences Research.
Antarctic Physical and Chemical Oceanography.

Arctic Marine Sciences:
Polar Biology.

Marine Board (MB)

NRC Staff Contacts: Jack Buller, Executive Director (telephone: 202-334-3119).

Board Chairman: John E. Filpas, Texas A&M University, College Station, TX 77843.

Objectives and Goals: "The Marine Board serves the national interest by initiating, and by responding to requests for evaluations and giving advice on the nation's capability to accomplish its marine and maritime objectives. In its advisory role, the Marine Board considers questions of the relation of engineering and technology to coastal and offshore resource development and operations; to navigation and the commerce of the sea and waterways; to related human resources and on-shore activities; and to the establishment and implementation of public policies. The board identifies opportunities and needs for engineering studies and new technologies and recommends appropriate actions."

Completed Reports:
Technologies for Measurement While Drilling.

Measuring Ocean Waves: Ocean Instrumentation to Serve Science and Engineering.

Understanding the Arctic Sea Floor for Engineering Purposes:
Current Projects:

Path and Effects of Drilling Fluids and Drill Cuttings in the Marine Environment.
National Capabilities for Arctic Ocean Engineering.

Pressure Across the West Florida Continental Shelf: Whitaker 1981-1982.
Geophysics, 38, in press (Photo courtesy of C. O. Martinov).

Engineering Support of Deep Ocean Drilling for Science:
Ship Collisions with Bridges.
Projects Contemplated:
Engineering Implications of Near Sea Level Changes.
Support of Ocean Science and Engineering Research.
National and International Cooperation and Information Exchange.

This information report was contributed by Barbara T. Richman, EOS News Writer.

News & Announcements

First Subsea Seismic Station

The first self-contained seismic station was installed recently in the ocean floor at a depth of 8.5 km, about 1,600 km southwest of Tahiti, close to the Tonga Trench. The region is thought to be the earth's most active seismic zone. The station will help scientists to determine if the subseafloor is a suitable place for recording seismic events by comparing noise levels with those of land-based stations and to determine whether marine seismic stations are possible to maintain. Eventually, marine stations could be used to help scientists predict earthquakes.

The computer-controlled seismic station, installed by the Naval Ocean Research and Development Activity's (NORDA) Marine Seismic System (MSS) Program Office, consists of four seismometers plus assorted sensors packaged in an 11 m long x 0.2 m diameter cylinder designed to resist corrosion and to withstand more than 700 kg/cm² of pressure. The cylinder was placed by the *Challenger* during Leg 1 of the Deep Sea Drilling Project (DSDP) in a 12-m deep hole drilled into the ocean crust. A recoverable 4,500 kg data processing package, resting on the ocean floor nearby, powers the station. The package, containing tape recorder, data processing equipment, and batteries, can record seismic signals for 45 days.

J. A. Ballard, manager of the Marine Seismic System program, said that the data produced by the subseafloor station is comparable to that produced by such land-based stations as Yellowstone, Northwest Territories, Canada, and the seismic station in La Jolla, Texas. The La Jolla station is considered by scientists to be the quietest one in the country. The MSS program is sponsored by the Defense Advanced Research Projects Agency (DARPA) of the Department of Defense.

SURF Request

The Southeastern Undersea Research Facility (SURF) of the University of North Carolina at Wilmington (UNCW) has issued a request for proposals to conduct research on the continental shelf of the Atlantic Ocean and the Gulf of Mexico during calendar year 1984. The research would be part of the National Oceanic and Atmospheric Administration (NOAA) National Undersea Program.

SURF is one of four national undersea programs established by NOAA's Office of Undersea Research to improve the understanding and management of marine resources. The program is operated by UNCW under a cooperative agreement with NOAA and is sponsored by the Southeastern Consortium for Undersea Research Efforts (SECURE), an association of academic and research institutions and government agencies from Virginia, North Carolina, South Carolina, and Georgia.

Proposals will be evaluated by the SECURE National Peer Review Committee. Investigators should address contemporary management problems in areas of research that include seafloor properties and processes; geological, geophysical, and geothermal aspects of the seafloor, including sediment transport, stability, fluxes, mineral resources, and gradients in the water column; ocean technologies and services; fisheries; and pollution.

Deadline for submission of proposals is September 30, 1983. For additional information contact NOAA (RD/SP2), 6010 Executive Blvd., Rockville, MD 20855 (telephone: 301-443-8891) or Southeastern Undersea Research Facility, University of North Carolina at Wilmington, P.O. Box 3725, Wilmington, NC 28406 (telephone: 919-343-4462 or 919-762-7615).

Meetings

Flow Cytometry and Sorting

For the first time oceanographers have a tool known as a flow cytometer and sorter, which is useful for simultaneous measurement of multiple parameters of individual cells and particles at rapid rates. We are now able to exploit the fluorescent capability of pigments and stains as signals to quantify and

Climatic Changes

ISBN 0-87590-206-5

M.I. Budyko

English Trans. R. Zolina

English Trans. editor: L. Levun (1977)

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separate subpopulations of cells and particles in the 1.0 to 150 µm size range. Analysis rates exceed 1000 cells per second and high sensitivity is attained using laser excitation.

The addition of this new technology to the ocean sciences will enable researchers to address problems which were previously intractable. The first unit, headed by the Office of Naval Research and the National Science Foundation, will be at Bigelow Laboratory for Ocean Sciences in West Boothbay Harbor, Maine, in the laboratory of Clarence M. Venchiar and David A. Plimney. In anticipation of this award, a workshop course on flow cytometry (FCM) and sorting techniques was held from October 24 through November 1, 1982, at the Bermuda Biological Station.

The workshop explored oceanographic applications of a Coulter Instruments Model EPICS V with one Coherent 5-Watt argon-ion laser. The participants brought samples of cell cultures and natural populations to test the feasibility and limitations of FCM to specific projects. Results from the first trials at Bermuda were promising, and we wish to bring the potential of this class of instruments to the attention of the oceanographers and limnologists. A follow-up workshop is being planned at the Bigelow Laboratory for Ocean Sciences for October 4-10, 1983.

Most oceanic productivity is directly linked to the first step in the food web, the phytoplankton—microscopic plants which convert solar energy into chemical energy of sugars and other compounds. Collectively, phytoplankton are the pastures of the sea. Phytoplankton as well as bacteria and small animals exist essentially as single cells and small entities in the fluid medium. Most of these forms are within the size limits of the flow cytometer, permitting physiological and ecological studies.

Phytoplankton have their own innate fluorescent materials such as chlorophylls and biliproteins, which are pigments used in photosynthesis. It is due to this autofluorescence that researchers recently discovered an abundance of very small (~1 µm), bacteria-like forms which contain pigments. These organisms, belonging to the cyanobacteria (or blue-green algae), are now found to be ubiquitous in the upper layers of the world's ocean. Although to date we know very little about what were previously thought to be "exotic" forms, in an evolutionary sense they are extremely interesting. Cyanobacteria probably were the first plant forms to colonize the oceans, and research has demonstrated that many have pigments which protect them from harmful ultraviolet radiation. By photosynthetically producing oxygen, these organisms are a fundamental support for life as we know it today.

Most methods currently used to quantify minute life forms either have been very tedious and statistically unreliable, such as microscopy, or have relied on bulk measurements, thus masking variance and rare events. Researchers have had great difficulty in distinguishing between living (organic) and nonliving (inorganic) forms. Indeed, inorganic sediments occupy the same size range as do the bacteria and phytoplankton. Now it is possible to use chlorophyll fluorescence to distinguish phytoplankton, protein stains to detect bacteria and small animals, and DNA stains to estimate growth rates. Light scattering can be a useful index for inorganic sediment particles using flow cytometry.

This meeting report was prepared by Joyce M. Venchiar of the Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, ME 04275.

